# AN ASSESSMEMNT OF THE IMPACT OF THE BIOMETRIC MANAGEMENT SYSTEM ON THE OPERATIONS OF THE NATIONAL HEALTH INSURANSE SCHEME – A CASE STUDY OF THE ASANTE AKIM NORTH NHIS DISTRICT OFFICE



By

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## DECLARATION

_I hereby declare that this submission is my own work towards the Master of Business Administration (Finance-Option) Degree and that, to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text‘.

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**DEDICATION**

I dedicate this thesis to my dear wife, Linda Agyeiwaa Boakye and my son, Joy Agyei Dorledzie

## ACKNOWLEDGEMENT

I am first and foremost grateful to the Almighty God for his mercies and strength he gave me to go through my thesis successfully. I wish to express my sincere gratitude and God‘s blessing to my supervisor, Mr. Gideon Boako who in spite of his busy schedules sacrificed his time to edit and guide my work and contribute to this work and all colleagues whose encouragement has inspired me during my research. Lastly to all who helped in diverse ways, I say God richly bless you all.



## ABSTRACT

The National Health Insurance Scheme has been facing a lot of challenges since its inception in the year 2004. The primary challenges among others include payment of claims to health providers under the scheme, registration and enrollment of citizens onto the scheme, etc. The Biometric Management System was then introduced in 2014 to cure certain problems being encountered such as the claims payment and enrollment. This study is thus motivated through the use of quantitative explanatory analysis to come out as the first hand information to ascertain the impact of the Biometric Management System (BMS) on the monthly enrollment and claims payment levels and to again analyse the trend taken by the enrollment and claims payment at the Asante Akim North and Central Districts.

The Paired-Sampled T test is employed as one of the most common experimental designs for the "pre-post" design. It is revealed that the correlation between the levels of registration between the two periods is not statistically significant at the 0.05 levels of significance. Similarly the correlation between claims payment over the two regimes or periods is also not significant. On the effects of BMS, it is proven that there is no significant difference between monthly mean of enrollment between the two regimes. Similar thing can be said about the mean difference in claims payment. However, the ordinary least square approach was used in determining the trend of enrollment and claims payment and it revealed that both have been taking an upward trend over the last three years.

Since the BMS has not taken immediate impact especially in claims payment as expected, it is recommended that to management to probe further for possible reasons for such failure. Moreover, the significant positive trend in levels of monthly claims payment should be considered alongside the revenue levels to the scheme in the district to bring the two to an acceptable level of pegging. This is very necessary if the future sustenance and improvement of the scheme is under consideration.

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# CHAPTER ONE

## 1.0 Introduction

Prepayments and risk pooling through social health insurance has been advocated by international development organizations. Social health insurance is seen as a mechanism that helps mobilize resources for health, pool risk, and provide more access to health care services for the poor. Hence Ghana implemented the National Health Insurance Scheme (NHIS) to help promote access to health care services for Ghanaians. Since its inception in the year 2004, the NHIS has undergone several changes aimed at improving the sustainability of the scheme. The areas which have seen such developments include method of registration, mode of payments to health providers and extension of the scheme. This study examines one of such innovations by finding the impact of the Biometric Management System (BMS) which is hoped to impact on the registration of clients and more important the payment of claims under the scheme.

## 1.1 Background of the Study

Health care financing continues to stir debates around the world. Many low and middle income countries especially, keep on exploring different ways of financing their health systems. This is due to the fact that their health systems are chronically under-funded (James, Hanson, et al,2006). User fees were initially introduced at the point of service delivery in some of these countries such as Ghana in order to generate revenue for the running of their health systems. In some contexts, the introduction of user fees led to improvement in the quality of health care services (Lagarde and Palmer, 2006). However, the overwhelming evidence suggests that user fees constitute a strong barrier to the utilization of health care services, as well as preventing adherence to long term treatment among poor and vulnerable groups (James, Hanson, et al, 2006)]. These

problems led to yet another debate to look for other alternatives of health care financing. In Ghana for instance, the problem escalated to a situation leading to the unwholesome system of health financing termed as ―Cash and Carry‖.

Joseph Kutzin'sas cited by Sodzi-Tettey, et al, 2012 framework for country led analysis of health care financing arrangements suggests four main system functions namely revenue collection, fund pooling, purchasing of services and provision of services. Purchasing of services refers to ―the transfer of pooled resources to service providers on behalf of the population for which the funds were pooled‖. The Ghana NHIS has a purchaser provider split, with the District Mutual Health Insurance
Scheme (DMHIS), and increasingly, the National Health Insurance Authority (NHIA), being directly responsible for entering into purchase agreements with providers and reimbursing them. Healthcare providers at the district submit claims to District Mutual Health Insurance Schememanagers (referred to as scheme managers).

But prepayment and risk pooling through social health insurance (SHI) and taxation are found to provide protection against some of the undesirable effects of user fees (Carrin, 2002). The international community is therefore paying more attention to SHI as one of the promising financing mechanisms for providing coverage to populations against high health care service costs (Hsiao and Shaw, 2007). SHI is seen as helping to pool health risks, prevent health related impoverishment and improvement in efficiency and quality of health care services (Carrin, 2002). It also provides access to health care services for the poor and helps mobilize revenue for providers.
Nonetheless, the implementation of SHI programmes are challenged in terms of high administrative cost, lack of managerial skills, problems of cost containment and

ensuring national coverage (Lagarde and Palmer, 2006). Due to these, there are still few examples of SHI schemes operating at large scale in developing countries (Lagarde and Palmer, 2006).

Ghana is among the few African countries that promulgated a National Health Insurance (NHI) law (Act 650). Previously, the country had been providing free health care services for her citizens after independence in 1957. This was possible due to the small population size (about 8 million) at the time and a flourishing economy Assensoh and Wahab, 2009. However, the free health care services could not be sustained because of the economic crisis in the 1970s and early 1980s which adversely affected all sectors of the economy leading to budget cuts on social spending including health and education. Thus, little money was available for the health sector and this led to widespread shortages of essential medicines, supplies and equipment which adversely affected the quality of care in public health facilities (Agyepong and Adjei, 2008).

In order to forestall these problems, cost recovery or user fees (popularly called ―cash and carry‖) was introduced in the late 1980s in all government facilities. Patients were made to pay for the full cost of medication and care. The argument for the user fees was to generate revenue and to discourage frivolous use of health care services. However, the user fees policy affected the utilization of health care services by Ghanaians. The poor especially, were undertaking self-medication and also reporting late to health facilities for treatment (Arhin-Tenkorang, 2001). This prompted the need to look for other alternatives of health care financing, which led to the introduction of some Community-based Health Insurance Schemes (CBHIS) in the early 1990s. As at 2003, such CBHIS covered only about 1% of the country‘s population (19 million), leaving

many Ghanaians uncovered against high health care service costs (Arhinful, 2003). However, since 2005, the mere proffering of the NHIS card has entitled the holder to quality basic healthcare, making it so popular that to date over nine million have been registered under the scheme, and still counting.



## 1.2 Research Problem

The NHIS like any other policy has to undergo a lot of changes aimed at improving its service delivery. The efficiency and sustainability of the NHIS depends on the tripartite stakeholders (the scheme, service providers and subscribers). The scheme is expected to ensure quick and timely disbursement of funds to the providers. On the part of the service providers, they must ensure quality service delivery to subscribers while the latter is expected to facilitate payment of premiums where appropriate.

One recent significant innovation implemented to enhance efficiency and speedy service delivery by the scheme has to do with the Biometric Management System (BMS). This system is specifically targeting such activities like registration of clients and clearing of claims submitted to the scheme by health service providers. It is against this backdrop that has necessitated the assessment of the impact of this BMS on enrollment and claims levels in the Asante Akim North District office of the NHIS.

The literature on health insurance claims processes generally makes little mention of work done in developing countries. Though rejection rates of claims submitted by providers on a national scale are not documented in Ghana, the Korle-Bu Teaching Hospital recorded range of rejected claims of 9-22% in 2008 according to the NHIA

Claims manager, 2009. Studies in Gujarat, India by Ranson in 2008 and Sinha et al in 2005 where a direct fee for service was operated among Self Employed Women's Association revealed claims rejection rates of 11% and 10-14% respectively and in the former, mean reimbursement rate of 76.5%. A 2002 survey by the Health Insurance Association of America (HIAA) showed that on average, 14% of claims received were denied for payment (HIAA, 2004). Using similar methodologies in 2002 and 2006, the American Health Insurance Plan (AHIP) showed varying levels of rejection of claims with no record of rejected or denied claims in 2006. Rather, 14% of claims were ―pended‖ or delayed for reasons including submission of duplicate claims, lack of complete information or other information needed to justify the claim, invalid codes or coverage issues, including no coverage based on date of service, noncovered or non-network benefit or service, coordination of benefits, or coverage determination (AHIP, 2006).

The responsibilities of the scheme and the service providers are spelt out clearly and briefly in Section 37(7) of the National Health Insurance Regulations, 2004 (L. 1 1809) as follows: ―A claim for payment of health care services rendered under a scheme licensed under this Act shall be filed within sixty calendar days from the date of the discharge of the patient or rendering of the service .On the other hand, section 38 (1) of the L. 1 1809 states ―A claim for payment of health care service rendered which is submitted to the scheme shall, unless there is any legal impediment, be paid by the scheme within four weeks after receipt of the claim from the health care facility.

It has been observed that, whilst health care facilities do honour section 37 (7) of L.1

1809, the scheme has not been able to comply with section 38(1) of the L.1 1809. This raises concerns about the efficiency of the scheme. As of June 2008 claims related to March, April, and May 2008 amounting to GH¢1, 132, 119. 34 which had been submitted by the health care providers had not been paid (Kwarteng, 2011).



### 1.3 Objectives of the Study

This study is aimed at achieving the following cogent objectives:

- To examine the impact of BMS on enrollment in the Asante Akim North and Central Districts.
- To assess the effect of BMS on submitted claims by providers in the two districts.
- To identify the monthly pattern of enrollment in the two districts.
- To identify the monthly pattern of submitted claims in the two district.

### 1.4 Research Question

The questions which are going to be answered emanating from the research objective include:

- How has the BMS influence the enrollment levels of the Asante Akim North District Office of the National Health Insurance Scheme?
- How has the BMS impacted on the claims submission levels at the district office?
- What has been the trend in enrollment onto the scheme in the two districts?
- What has been the trend in claims submission by providers in the two districts?

## 1.5 Relevance of the Study

The successful implementation of the National Health Insurance Scheme in Ghana is fundamental to ensuring access and affordability of health care services in the country by a majority of Ghanaians in view of recent terrible economic situation Ghanaians find themselves. Currently, a little over 50% of Ghanaians have registered with the scheme (Kwarteng, 2011). The success or otherwise of the scheme will have a tremendous impact on the health care system in the country.

The study on the impact of the Biometric Management System in the Asante Akim North and Central Districts will provide useful information on the operations and sustainability of the scheme at the district level. Thus, the expected effects of the BMS on vital variables such as the levels of registration and efficiency in payments of claims which the sustainability of the scheme hinges on cannot be overemphasized. This study will provide insightful empirical data that will enhance understanding of the issues, thereby contributing to the design and implementation of universal health insurance in Ghana.

Finally, the study will act as a basis to undertake further research on healthcare financing and methods of payments of claims in various metropolis, municipalities and districts in Ghana. The researcher also stands to gain considerable knowledge and skills in both research and health financing issues.

## 1.6 Scope of the Study

The study is about the operations of the NHIS in the Asante Akim North and Central districts which have their capitals at Agogo and Konongo respectively. It focuses on the effect of the BMS on the registration of clients to the scheme within the two districts as well as the impact on claims payment to health providers.



## 1.7 Organisation of the Study

The study consists of five (5) chapters. Each chapter is divided into different sections and sub-sections. The rest of the study is organised as follows:

The chapter two discussed the review of relevant literature on the operations of the National Health Insurance Scheme especially at the district level. Chapter three introduced the methodology employed in the study to achieve the stipulated research objectives. The chapter four is divided into data presentation and analysis. Chapter five presents the main findings, recommendations and some concluding remarks.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.0 Introduction

This chapter reviews some related literature regarding the operations of the NHIS over the years in Ghana. It also forms the theoretical basis upon which the study was conducted as well as how the empirical review of the study area has been carried out. It concentrates on the literature regarding the various findings and opinions expressed on the topic, impact of the NHIS on health delivery in Ghana with emphasis on the registration and claims payment.

## 2.1 Theoretical Literature

People seek security in aspects of life. A sense of security may be the next basic goal after food, clothing, and shelter (Judy and Robert, 2005). According to them, an individual with economic security is fairly certain that he can satisfy his needs (food, shelter, medical care, and so on) in the present and in the future. Economic risk-which Judy and Robert simply refer to as risk-is the possibility of losing economic security. Most economic risk derives from variation from the expected outcome.

One measure of risk, used in this study, is the standard deviation of the possible outcomes. For the purpose of illustration, consider the cost of a car accident for two different cars, a Porsche and a Toyota. In the event of an accident the expected value of repairs for both cars is 2500. However, the standard deviation for the Porsche is

1000 and the standard deviation for the Toyota is 400. If the cost of repairs is normally distributed, then the probability that the repairs will cost more than 3000 is 31% for the Porsche but only 11% for the Toyota.

Modern society provides many examples of risk. A homeowner faces a large potential for variation associated with the possibility of economic loss caused by a house fire. A driver faces a potential economic loss if his car is damaged. The individual health condition is at risk especially when he is uncertain about the cost of his medical bills. A larger possible economic risk exists with respect to potential damages a driver might have to pay if he injures a third party in a car accident for which he is responsible.

Historically, economic risk was managed through informal agreements within a defined community. If someone‘s barn burned down and a herd of milking cows was destroyed, the community would pitch in to rebuild the barn and to provide the farmer with enough cows to replenish the milking stock. This cooperative (*pooling*) concept became formalized in the insurance industry. Under a formal insurance arrangement, each insurance policy purchaser (*policyholder*) still implicitly pools his risk with all other policyholders. However, it is no longer necessary for any individual policyholder to know or have any direct connection with any other policyholder.

Insurance is an agreement where, for a stipulated payment called the *premium*, one party (the insurer) agrees to pay to the other (the policyholder or his designated beneficiary) a defined amount (the *claim payment* or *benefit*) upon the occurrence of a specific loss. This defined claim payment amount can be a fixed amount or can reimburse all or a part of the loss that occurred. The insurer considers the losses expected for the insurance

pool and the potential for variation in order to charge premiums that, in total, will be sufficient to cover all of the projected claim payments for the insurance pool. The premium charged to each of the pool participants is that participant‘s share of the total premium for the pool. Each premium may be adjusted to reflect any special characteristics of the particular policy. It can be shown that, the larger the policy pool, the more predictable its results. Normally, only a small percentage of policyholders suffer losses. Their losses are paid out of the premiums collected from the pool of policyholders. Thus, the entire pool compensates the unfortunate few. Each policyholder exchanges an unknown loss for the payment of a known premium.

Under the formal arrangement, the party agreeing to make the claim payments is the insurance company or the *insurer*. The pool participant is the policyholder. The payments that the policyholder makes to the insurer are premiums. The insurance contract is the policy. The risk of any unanticipated losses is transferred from the policyholder to the insurer who has the right to specify the rules and conditions for participating in the insurance pool. The insurer may restrict the particular kinds of losses covered. For example, a *peril* is a potential cause of a loss. Perils may include fires, hurricanes, theft, and heart attack. The insurance policy may define specific perils that are covered, or it may cover all perils with certain named exclusions (for example, loss as a result of war or loss of life due to suicide).

*Hazards* are conditions that increase the probability or expected magnitude of a loss. Examples include smoking when considering potential healthcare losses, poor wiring in a house when considering losses due to fires, or a California residence when considering earthquake damage. In summary, an insurance contract covers a

policyholder for economic loss caused by a peril named in the policy. The policyholder pays a known premium to have the insurer guarantee payment for the unknown loss. In this manner, the policyholder transfers the economic risk to the insurance company. Risk in this study will be defined therefore as the variation in potential economic outcomes. It is measured by the variation between possible outcomes and the expected outcome: the greater the standard deviation, the greater the risk.

Financing an efficient and effective health care system is of a major concern to countries all over the world. This is even more critical in developing countries where there are several developmental challenges of which limited resources and poverty are dominant. Health care financing is a general term which refers to the resources used in providing health care. These include money, and other resources such as labour, equipment and supplies (Goodman & Waddington, 1994).

In Ghana, healthcare financing has gone through several phases. After independence in 1957, Ghana adopted a socialist centralist development approach with the state taking absolute control over the provision of social services including health, which at this period, was free in public health facilities. The provision of health care was financed by the state through tax revenue. However, it became obvious that this method of financing health care was not sustainable following the economic difficulties the country experienced from the beginning of the 1960s (Osei-Akoto, 2004).

The attempt to correct some macroeconomics variables and instill fiscal discipline so as to revamp the Ghanaian economy led to the state beginning to reduce expenditure on

the provision of social services and the health sector. The erstwhile Provisional National Defence Council (PNDC) government in year 1985 passed an instrument (L. I. 1313) which introduced user fees for all medical conditions except certain specified communicable diseases. The main aim of L. I. 1313 was specifically to enable hospitals to totally recover all costs involved in their operation. This system whereby people who access public health facilities pay user fees became known as _cash and carry‘ and resulted in several operational challenges as well as people in the country (Asenso-Okyere, Osei-Akoto, Anum, &Adukonu, 1998).

Moreover, the introduction of the user fees and the full cost recovery for drugs as a way of generating revenue led to a remarkable decline in the utilization of health service in the country. People inability to afford these basic health care services resorted to such practices like self-medication and the use of herbal drugs. It was estimated that only 20% of people who require health care were able to access it (National Health Insurance Scheme, 2004).

In order to ameliorate the problems associated with the ―cash and carry‖ system the then New Patriotic Party (NPP) government introduced the National Health Insurance Law, Act 650 in 2003. It sought to provide basic health care services to persons resident in Ghana through mutual and private health insurance schemes, and to establish a National Health Insurance Fund that will provide funding for basic health services for the citizenry.

In 2001, Ghana started the process of developing a National Health Insurance Scheme

(NHIS) to replace out-of-pocket fees at the point of service delivery (Agyepong and Adjei, 2009). In2003, NHIS Act 650 was passed and became operational in 2004 (NHIA, 2004). By June 2009, coverage stood at 55%of the population from a total of 145 District Mutual Health Insurance Schemes (DMHIS) according to Jehu-Appiah, et al. 2011.



The empirical associations among NHIS enrolment and health service usage appear strong. Since the inception of the NHIS, many studies have been carried out on the willingness and acceptability of the NHIS, the determinants of enrolment into the NHIS, and the health seeking behaviour of insured clients.

According to a study by Blanchet, Fink and Osei-Akoto (2012) on the effect of the NHIS on health care utilisation, the NHIS‘s goal of improving access to health care has been achieved at least among adult women living in the Accra Metropolitan Area, their study area. Asenso-Okyere, Osei-Akoto, Anum and Appiah (1997) in a study on the willingness to pay for health insurance in developing countries and found more than 90% of the respondents agreeing to enroll in the NHIS and about 64% willing to pay a monthly premium of $3.03. On determinants of enrollment into the NHIS, it was also shown that individuals from poorer households were less likely to enroll compared with those from rich households (Jehu-Appiah, Aryeetey, Spaan, De Hoop, Agyepong&Baltussen, 2011). This conclusion was also arrived at by Dixon, Tenkorang and Luginaah, (2011) in their study ―Ghana's national health insurance scheme: helping the poor or leaving them behind?‖. Intuitively, it is expected that as more expectant mothers enroll on the NHIS, this should positively influence their utilisation of a health facility for delivery.

Joseph Kutzin's framework for country led analysis of health care financing arrangements suggests four main system functions namely revenue collection, fund pooling, purchasing of services and provision of services (Kutzin, 2001). Purchasing of services refers to ―the transfer of pooled resources to service providers on behalf of the population for which the funds were pooled‖. The Ghana NHIS has a purchaser provider split, with the DMHIS, and increasingly, the National Health Insurance Authority(NHIA), being directly responsible for entering into purchase agreements with providers and reimbursing them. Healthcare providers at the district submit claims to DMHIS managers (referred to as scheme managers).

All over the world, countries adopt different methods of collecting revenue to finance health care. Some of these methods are taxation, out-of-pocket payments, and social health insurance, among others. In 1998, nearly 30% of global expenditure on health which was estimated at US$ 3.1 trillion came from taxation, around 20-25% was from out-of-pocket payments and the same from social health insurance (SHI) contributions, with another 15% by private insurance. There is a wide variation in the sources of financing. Asian and African countries spent more from out-of-pocket than from government general revenue or social health insurance as compared to European countries (WHO, 2008).

The methods used to finance personal health care service play a major role in shaping a country's health care system. Personal health care includes services such as hospital care, physician care, dental services, and drugs that are provided directly to individuals.

How this care is financed influences how people access health care, the types of health care provided, and the mechanisms used to allocate health care services. Financing methods also influence how the costs of health care are distributed among members of society by income and by health status.

In 2008 a new tariff structure was introduced by the NHIA, based on a DiagnosisRelated Group (DRG) system (paying per episode of care, according to disease groups, but also differentiated by level of care and sector). This replaced the previous payment system which was based on fees for service.

Although financial data is not yet available from the NHIA to analyse the overall impact of the new tariffs, scrutiny of selected health facilities claims shows an immediate jump in NHIS claims, sometimes a doubling within the month of the new tariff being introduced.

Drug costs are currently billed separately on top of the fixed DRG payment per episode, and it is reported by the NHIA that the number of drugs per prescription have increased, from 4.5 in 2004 to 6 now, with some more expensive drugs being particularly favoured by some doctors.

Another common result of the introduction of DRG systems is ―tariff creep‖ – shifting to diagnoses which attract a higher tariff - which is being reported by NHIA informants. (We don‘t get simple malaria cases any more – all malaria is complicated)

In addition to the increase in tariffs and increase in members, there has been an increase in utilisation of services by members, which is the expected result of any reduction in

financial barriers to care. While this is a positive development (OPD per capita visits remain under the expected norm), it is also something to monitor carefully, in terms of the implications for cash flows and, ultimately, sustainability. Increased utilisation of curative care is not self-evidently positive and care patterns can be distorted by provider interests and also unequal access by different groups. In addition, improving the quality of care is critical to realising health gains from increased utilisation.

There is considerable interest in exploring the potential of social health insurance to increase access to and affordability of health care in Africa. Social health insurance is seen as one of the health financing approaches with a strong potential to share risks across population groups and time (Wagstaff, 2009). As membership is mandatory, it avoids many of the problems of adverse selection which smaller, voluntary health insurance schemes face. A number of African countries are currently experimenting with different approaches, including Nigeria, Rwanda, Kenya, Tanzania and Ghana. As these schemes are still young and evolving, few have yet been systematically evaluated.

Access to more generous health insurance is hypothesized to affect households in several ways. Firstly, access to health insurance is expected to reduce out-of-pocket health expenses (Xu et al., 2003; Chaudhury and Roy, 2008). Uninsured households need to devote a larger part of their budget to fixing a health problem, i.e. spending on healthcare, which diverts resources from the consumption of other goods (Gertler and Gruber, 2002; Chetty and Looney, 2006).

Secondly, health insurance might have opposite effect on health (Goldman et al. 2007; Miller et al. 2009; Barros 2009). On the one hand, utilization of healthcare services

might increase. On the other hand, there might be changes to the quality of care as well as to the quantity of care.

Thirdly, health shocks might diminish the capacity of the household to generate income because, for example, a household member is not healthy enough to work. If better health insurance leads to better health, then it might cushion households against this labor productivity channel (Currie and Madrian, 2005). Finally, health insurance has become essential in mediating the high costs of childbirth. Even though it has been neglected in fertility research, health insurance coverage may be an economic determinant of fertility.

**2.2 Enrollment**

The government of Ghana adopted the National Health Insurance Scheme (NHIS) in 2003, which was fully implemented in 2005 with the view of promoting and achieving universal coverage and equity in health delivery in the country. The NHIS aims to assure equitable and universal access for all residents of Ghana to an acceptable quality package of essential health care services without out-of-pocket
(OOP) payment being required at the point of use (National health insurance Bill, Memorandum. 2003). The ultimate goal of the NHIS is the provision of universal health insurance coverage for all Ghanaians, irrespective of their socio-economic background. The NHIS is based on District Mutual Health Insurance Schemes (DMHIS), which operates in all 170 districts of the country. The NHIS covers both the formal and informal sectors of the economy. According to McIntyreet al., the implementation of the NHIS draws experience from the operations of the CBHIS (McIntyre, 2005). As at June, 2009,about 67% of the Ghanaian population had subscribed to the NHIS (Asenso-Boadi, 2009).

### 2.3 Claims Submitted

Since its full implementation in the year 2005, different methods of payment by the NHIS to health providers have been introduced. In its initial stage, the fee for service type of provider payment mechanism was used for paying health care providers initially. Butthis was replaced with the Ghana Diagnostic Related Groupings (GDRGs) in April, 2008. The reason for the replacement was that the fee for each service was found to be low and hence unattractive, especially for the private providers to participate. Providers are encouraged to participate in the NHIS, in order to reduce congestions and delays for clients when seeking health care services. With the fee for service, providers were also required to submit detailed information on all services and charges for claims submissions. This involves a lot of paper work which providers were not happy with (Ankoma, 2009).

In an attempt to improve claims submission and time payment, the GDRGs were introduced. This in the view of the NHIA was to help remedy some of the difficult issues of the fee for service system. The tariff covers the full cost of the estimated direct consumables for direct patient care, anesthesia and other investigations. The GDRG also captures about 80% of the estimated overhead cost for public health facilities, comprising of building and equipment maintenance, housekeeping and utilities (Ankoma, 2009). It is expected that the new tariff will generate adequate revenue from the NHIS for providers to cover a significant portion of their cost of operation. But, currently the NHIS is experimenting with capitation in the Ashanti Region of Ghana, to test its feasibility for scaling up, along side the GDRG.

### 2.4 History of the NHIS in Ghana

Ghana is among the few countries in Africa that has taken steps towards early efforts to establish a National Health Insurance Scheme. The search for an alternative means of

financing and provision of sustainable and affordable health care service for Ghanaians has been among the priorities of successive governments since independence (Kwarteng, 2009). Between 1960 and 1966, a nation-wide health insurance funded from tax revenue was introduced in Ghana. Free health service was made available at all the country‘s healthcare facilities. Again, in 1970, a committee headed by Dr. Konotey-Ahulu was constituted to make proposals for the introduction of a health insurance scheme. This led to the enactment of the Hospital Fee Act 387 of
1971, which replaced the free health scheme initiated during the First Republic. However, the process of establishing a health insurance scheme for the country was aborted following the 1972 military coup. The preparation of legislative instrument to operationalise the Hospital Fee Act 387 of1971 was started during the Third Republic but was once again thwarted by the military regime of 1981 (Adoma-Yeboah, September 14, 2005).

The Provisional National Defence Council (PNDC) government in July 1983 introduced partial cost sharing of health services when Ghana‘s economy was on the verge of collapse. It did so through the enactment of the Hospital Fee Regulation which was later updated by L. I. 1313 of 1985. The country had by then become more interested in cost recovery. In 1985, the government initiated studies into alternative means of financing healthcare by entering into a bilateral technical assistance contract with a German firm that would have studied the feasibility of creating a National Health Insurance Programme. This could not materialize, and a local consultant was engaged to carry out the studies whose report was also not followed up.

In 1997, the Ministry of Health set up its first Directorate for National Health Insurance. A national forum on health insurance scheme was convened. This resulted in the setting up of the Ghana Healthcare Company by the Social Security and National Insurance

Trust (SSNIT) to provide other sources of health financing. Another effort was made by the Ministry of Health to pilot a health insurance scheme in Koforidua in the Eastern Region which did not start. However, health insurance schemes were set up in the urban areas of the country by some private organisations for profit. Vanguard Assurance Company instituted a scheme with the Association of Private Medical Practitioners as providers; Metropolitan Insurance Company formed the Metcare Health Insurance Scheme and Provident Insurance, the Medex Health Insurance Scheme.

Consequently, some of these schemes are reorganizing, following the passage of the National Health Insurance Law whilst others have wound up. Gemini Life Insurance Company (GLICO) is also setting up a private mutual insurance scheme. Some other non-profit private health insurance schemes such as the Mutual Health Organisations at Nkoranza, Damango, Tano, Jaman, and Dangme West districts and others mostly supported by Non-Governmental Organisations and religious bodies in various parts of the country, especially the rural areas sprang up (Adoma-Yeboah, 2005).

In April 2002, the Ministry of Health came out with a policy framework to guide the implementation of District-Wide Mutual Organisations. It selected 45 districts throughout the country including the existing Mutual Health Organisations, to pilot the National Health Insurance Scheme (MOH, 2003).

The current health insurance scheme operating in the country was established in 2003 by an Act of Parliament, Act 650 to replace out- of-pocket payment at the time of health service use. The Act makes it mandatory for all residents in the country to belong to a health insurance scheme. Two types of health insurance are in operation namely the social and private health insurance schemes. Under the private there are the Private

Mutual Health Insurance Schemes (PMHIS), and the Private Commercial Health Insurance Schemes (PCHIS).

The DMHISs now established in 145 districts of the country to serve as a strategy for delivering its pro-poor policy to the under-privileged segment of the society. The DMHISs incorporate members from both formal and informal sectors. A Ghana News Agency Report (April, 2002) shows that, total registered members to the schemes in Ghana was 11,279,678 as at the end of 2007, representing 55% of the population, and total active membership was 9,773,100 as at the end of 2007, representing 48% of the population. During the same period, number of ID card bearers stood at 8,203,855 representing 42% of the population.

Members of a scheme contribute according to the principle of ability to pay and package of health services cover of over 95% of diseases afflicting Ghanaians. There is differential contribution level both in the formal and informal sectors of the society. The formal sector workers contribute 2.5% of their 17.5% Social Security and National Insurance Trust (SSNIT) contribution whereas informal sector workers contribute at least seven cedis twenty pesewas per annum. The contribution levels have an inbuilt cross-subsidization mechanism whereby the rich pay more than the less privileged, adults pay on behalf of children, the healthy cover the sick and urban dwellers pay more than the rural dwellers. Children less than 18 years and adults over 70 years are covered free of charge (National Health Insurance Scheme, 2004).

Contribution level of the people is categorized based on their socio-economic stratification. The policy has grouped Ghanaians into six main categories: core poor, very poor, poor, middle income, rich, and very rich. All these categories of people pay in line with their ability to pay. The state instituted a 2.5% National Health Insurance

Levy payable on selected goods and services. Funds raised from this source are used to subsidize the contributions of the underprivileged in society and to pay for the contributions of the core poor and other vulnerable groups.

Service providers within the public, private and mission sectors provide the benefit package under the scheme after satisfying accreditation criteria. As at December 2007, all the Public Healthcare Providers, and 800 Private Healthcare Providers have been accredited. For a period of two years (2005 to 2007), utilization of healthcare facilities under the scheme increased from 3,213,450 to 6,835,104. A gatekeeper system is in place as a cost control measure. Gatekeeper system is a system which ensures that a visit to the secondary and tertiary health facilities is by referral from a primary health facility. There exist private mutual health insurance schemes. These are not of district focus. They are either community-based or occupational or faithbased. Goldfields Mutual Health Insurance Scheme (GMHIS) established in 2007 by the Goldfield Ghana Limited for the employees of the company is typical example.

These schemes do not receive subsidy from the government.

### 2.5 Health Insurance Theory

The role of health insurance in health care financing could be seen in two ways: Firstly, to raise revenues for health care services; Secondly, to pool resources so that health risks could be shared among members of a health insurance scheme (Folland, Goodman & Stano, 2004). Given the uncertainty with which an individual is affected by ill health in the population, risk sharing is not only an equitable way of financing health care but also an effective one. Indeed, important policy outcomes of health insurance are to improve access to care and to prevent catastrophic health expenditure on an individual by reducing their spending on medical care at the time of use, which is particularly important for those with limited ability to pay. By bringing the direct price of health

care down, consumption of care is expected to increase, ceteris paribus. However, the extent to which this occurs in any given context is an empirical issue, given other factors, such as indirect costs, that may still impede access to care by some groups of the population of a country.

Generally, health insurance is treated as a consumer good whose value lies in smoothing consumption across risky nations. Adverse selection and moral hazard play integral roles when modeling demand for health insurance. Adverse selection refers to the case where individuals differ according to their risk (of ill health) and when faced with the same menu of insurance options, riskier persons are more likely to purchase insurance or purchase higher coverage since the expected benefits are greater (Rothschild & Stiglitz, 1976).

Intuitively it is expected that individuals with worse health are more likely to purchase insurance, holding other things constant, since they have greater expected use of the health care facilities and greater health related expenditure. In the absence of knowledge about the risks of illness in different population groups, insurers may be compelled to charge a uniform premium that is likely to be higher than what people in low-risk groups are willing to pay. This may lead to an upward movement of the premiums, making them unaffordable to many, including even the high-risk
individuals. This explains why there is a general lack of market for health insurance in sub-Saharan Africa (Odwee, Okurut, & Adebua, 2006).

Simple models of self-selection support this intuition (Chiappori & Salanie, 2000). For instance, in models with two type of risk, a separating equilibrium would show that insurance contracts taken up by low-risk individuals have low premiums and high co-payments as opposed to the contracts chosen by high-risk types, characterised by high

premiums and low co-payments. These models also predict the likelihood of incomplete markets in equilibrium since the low-risk individuals may be driven out of the market. This situation occurs when we have universal public insurance system. Low-risk types may prefer the public system as opposed to a private contract offering incomplete insurance (Vera-Hernandez, 1999).

Individuals who are insured have lower costs in the ill health states and take fewer precautions or invest less in preventative measures. This is what is referred to as moral hazard. Moral hazard effects occur after the purchase of insurance and refer to the consumers‘ change of behaviour in such a way as to alter the distribution of probabilities across health states. That is, the insured‘s demand for health care is sensitive to the excessive demands for medical attention. If insurers do not make adequate allowances for such behaviour, premium may be too small to cover treatment cost. This definition follows the general microeconomic treatment of moral hazard rather than the alternative definition given by Pauly (1968) which is often used in the health economics literature. It must be noted that adverse selection and moral hazard are not the subject of this study.

The conventional theory of health insurance has held that becoming insured is more or less like a reduction in the price of health care, just as if the price reduction had occurred exogenously in the market. Newhouse (1978) writes: For the purpose of studying the relationship between health insurance and demand, the important point is that insurance is like a subsidy to purchase medical care; that is, it lowers the per-unit price of care. Although there is an income effect caused by premiums or taxes paid to finance the insurance benefits, these income effects can be shown to be empirically negligible in their effect on the demand for care.

According to this theory then, the mechanism by which insurance is financed can be ignored because the effect of premiums on the demand for medical care—an income effect—is empirically negligible. Because of this theory, many health economists have focused on policies that would reduce consumption at the margin. For example, Feldstein (1973) argues that the tax subsidy for employer-based health insurance has resulted in American families spending too much on health care. He concludes that raising the coinsurance rate from 33% to 67% would increase society's welfare. Others like Manning and Marquis, (1996); and Feldman and Dowd, (1991) have drawn similar conclusions.

# CHAPTER THREE

# METHODOLOGY

## 3.1 Introduction

The chapter focuses on the procedures adopted in carrying out the study. These covers the profile of the study area and organization, research design, population, sampling and sample size, sources of data, data collection instruments and data collection method.

## 3.2 Profile of the Study Area and Organisation

The study is carried out within the Asante Akim North Municipality which is located in the Ashanti region of Ghana. It covers a land area of 1,160 square kilometres which is about 4.5% of the region. The Asante Akim North District was made a Municipality in the year 2010 and subsequently divided into Asante Akim North and Asante Akim central in 2012. However the Asante Akim North District office of the NHIS is in charge of both districts.

The Asante Akim North has Agogo as its capital and has a district population of 69,186 which consists of 33,731 males and 35,455 females. The Central district also has Konongo as its capital and with a population of 71,508 with 33,945 males and 37,566 females.

The economic activity of the inhabitants of both districts is mostly farming with a vast majority of the people being peasant farmers who rely mostly on the weather for their farming activities.

The administrative office of the Scheme is located at Konongo. The Scheme is operated by five member management team which consists of the District Director, Public

Relations Officer, Management Information Systems Officer, an Accountant and the Operations and Provider Relations Officer. The top officers are supported by assistants and other staff.

The District Director is the head of operations in the district and supervises the activities of the various divisions in the district office to ensure that the subscribers are satisfied with the services rendered.

The PRO ensures the necessary education of contributors/communities on all aspects of the scheme, coordinates registration of members, implements programs to promote the image of the scheme, coordinates the distribution of Membership ID and also educate members on the benefits of the scheme, all these activities are carried out by the PRO to ensure customer satisfaction and retention.

The Administrative and finance manager is responsible for the financial function of the office, the division establishes and maintains proper financial books of account, prepares monthly bank reconciliation statements of work, institutes internal control mechanisms for proper financial management, produces quarterly financial reports to the district director, assists the district director in the preparation of annual budget etc. These activities ensure that funds are channeled to the right places for customer satisfaction.

The district operations and provider relations manager is also responsible for the daily operations of the scheme and receives claims from service providers, checks the accreditation status of the providers and the completeness of the claims submitted, sorts and batches the claims according to service provider and period, provides feedback on claims to providers, collaborates with MIS officer to develop statistical data on claims

and produces quarterly claims reports to the district director. This division collaborates with the health facilities to ensure quality service delivery to subscribers.

The MIS division is responsible for the management of data, equipment and software in the district office. The division collects, collates and analyzes data from various units, transmits data to Data Processing Centre for the printing of ID cards, receives printed ID cards and ensures their prompt distribution to clients, provides input in the designing of systems and methods for collection and reporting on the office, develops and maintains personnel database for the office and maintains and updates MIS software.

The geopolitical nature of the districts also makes it a typical area for the conduct of the study since findings in the study can be easily applied and extended into other similar several jurisdictions within the country.

### 3.3 Research Working Definitions

This section deals with the estimation of an econometric model based on the information gathered from the scheme at the district. The dependent variable will be the enrolment onto the scheme levels and claims submitted by health providers and the independent variables based on our research objectives is the Biometric

Management System. This is expressed in some functional relation as

$$Yi=f(Xi) \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

In the equation (1) above, the Y is the dependent variable of the model, X is the independent variable and the i‘s are the observed value for the variables.

The two most important statistical frameworks for modelling and estimating a linear relationship between variables are the Ordinary Least Square (OLS) and the Maximum Likelihood approaches. In this study, we employ the OLS to estimate and test the linearity of relation if any between quantities such as enrolment levels and time as a

dummy variable. There exist a number of reasons for using this econometric technique for such a study. In the first place, the parameter estimates obtained from the OLS have some optimal and desirable properties described as BLU (Best, Linear and Unbiased) and above all, minimum variance property. Secondly, the computational procedure of the OLS is fairly and relatively simple while the data requirement is also not excessive. Again, the least squares method has been used in a wide range of economic relationships with fairly satisfactory results, and, despite the improvement of computational equipment and of statistical information which facilitated the use of other more elaborate econometric techniques, OLS is still one of the most commonly employed methods in estimating relationships in econometric models. Furthermore, the mechanics of least squares are simple to comprehend. Finally, OLS is an essential component of most other econometric techniques. In fact, with the exception of the Full Information Maximum Likelihood method, all other techniques involve the application of the least squares method, modified in some respects (Koutsoyiannis, 2001)

### 3.3.1 Time Series Analysis

Time series is sequence of observations (Yt) ordered in time, normally at equally spaced time interval. If there is only one quantity/variable upon which observations are made, then it is called a single time series (univariate time series). The basic assumption in time series analysis or modeling is the fact that certain parts or aspects of the past pattern will persist and continue to remain in the near future. Again, the time series process is assumed to be based on past values of the main variable but not on predictor quantities which may affect the variable in question. Thus in time series modeling, the prediction of values for the future periods is based on the pattern of past values of the variable under study, but not generally on predictor quantities/variables which may affect the system.

There are basically two major approaches that are traditionally used to model a single time series. One of such approach which is predominantly employed by this study is when observations are modeled as a function of time. In general, such models are written as:

$$y_t = f(t;\beta) + \varepsilon_{t,}$$

In this model above, $\beta$ $and$ $\varepsilon$ are unknown coefficients and uncorrelated errors respectively and the $t$ is the dummy variable, time. Through the selection of appropriate fitting functions, one can represent a variety of non-seasonal and seasonal data series. The parameters are estimated basically by ordinary least squares, which weights all observations equally or by weighted (discount) least squares.

### 3.4 Research Design

The study is a sectional one with data emanating from the operations of the Asante Akim North NHIS district office. An explanatory research method was employed by using basically quantitative data. This explanatory studies according to Saunders et al, 2012 establish causal relationships between variables. In addition to the explanatory method, descriptive methods are also employed. In descriptive method, the aim is to gain an accurate profile of event, persons or situations. These two methods combined are known as descripto-explanatory studies (Saunders et al, 2012).

Data from secondary sources was used for the study. Secondary data was gathered from sources including various published sources or database of the district health insurance scheme, journals and internet resources as well as the Administrative and Procedural manuals, etc. Data collected was analyzed using descriptive statistics like mean, tables and graphs, etc.

The last three to four year's monthly data ranging from January, 2011 to June, 2015 on enrolment onto the scheme, claims submission by health providers, etc. are collected. This period is not accidentally chosen but after careful consideration of the inception of the Biometric Management System in the NHIS. The collected data will therefore enable the complete assessment of the impact of the BMS in the operations of the NHIS in the district such as registration/enrollment and payments of claims to health providers. There are various statistical models available to analyse the data to achieve specific objectives of the study.

### 3.4.1 Study Population and Data Source

The Biometric Management System (BMS) started in the Asante Akim North NHIS District office in July, 2014, hence the collection of monthly data for the last twelve months prior to July, 2014 and the next twelve month data post July, 2014 will aid in analyzing the impact of BMS quite clearly on enrollment and claims. However, available data from January, 2011 to July, 2015 were used to study the pattern of trend in enrollment and claims. The population of the study can therefore be described as the entire clients of the National Health Insurance Scheme in the Asante Akim North and Central Districts.

## 3.5 Ethics

For the purposes of this study, permissions will be sought from the relevant bodies in the National Health Insurance Scheme in the district as well as health providers and any other bodies as and when required. An oral address explaining the rationale for the study, will be made on site to seek consent of authorities. Anonymity will be ensured at all times; save identification numbers and signatures. Information provided shall be respected as private and confidential.

# CHAPTER FOUR

# DATA PRESENTATION AND DISCUSSION

## 4.1 Effect of BMS

The effect of the Biometric Management System on monthly levels of enrollment or registration onto the insurance scheme and the monthly level of claims payment to health service providers is assessed using parametric statistical models. This is as a result of satisfying certain conditions necessary to conduct Z and T tests of hypothesis concerning the mean of a normal distribution or any other known distributions. Thus, the procedures which assume that either we are sampling from a normal distribution or sample sizes are large enough like the t-test could not be applied under this situation for the use of test like the one-sampled T test. In reality, our sampled data is realistic to assume an underlying normal distribution and for which sample sizes are small. It is therefore statistically prudent to result to powerful _parametric' test for location rather than the usual _nonparametric' tests.

The One-Sample Kolmogorov-Smirnov procedure is employed by the study to test the null hypothesis that the sample comes from a particular (Normal) distribution. In table 4.0 below, the data on monthly levels of enrollment onto the scheme prior to the introduction of BMS in July, 2014 and after the introduction of BMS to July, 2015 is tested for normality. In all, twenty-four (24) data units (monthly registration over a twelve month period pre and post BMS respectively) are used with normal means of 5362.17 and 5843.83 for periods prior to BMS and post BMS respectively. The standard deviations for the two periods are respectively 1766.278 and 1979.434. The next three rows fall under the general category ―Most Extreme Differences‖. These differences include the largest positive and negative points of divergence between the empirical and

theoretical Cumulative Distribution Functions (CDFs).The first difference value, named as Absolute, is the absolute value of the larger of the two difference values printed directly below it. This value will be required to calculate the test statistic. The Positive difference is the point at which the empirical CDF exceeds the theoretical CDF by the greatest amount. At the opposite end of the continuum, the

Negative difference is the point at which the theoretical CDF exceeds the empirical CDF by the greatest amount. The Z test statistic is the product of the square root of the sample size and the largest absolute difference between the empirical and theoretical CDFs. It is worthy to mention here that, unlike much statistical testing, a significant result in this is bad news. The probability of the Z statistic (P-Value) is greater than 0.05-the level of significance-meaning that the Normal distribution with a parameter of 5362.17 is a good fit for the monthly levels of registration onto the scheme. In other words, the distribution of the monthly registration data can be described as normal.

**Table 4.0.1 One-Sample Kolmogorov-Smirnov Test**

| | | Monthly Enrollment/Registration Post BMS | Monthly Enrollment/Registration Pre BMS |
|---|---|---|---|
| N | | 12 | 12 |
| Normal Parameters[a] | Mean | 5,362.17 | 5,843.83 |
| | Std. Deviation | 1,766.278 | 1,979.434 |
| Most Extreme Differences | Absolute | .256 | .199 |
| | Positive | .256 | .199 |
| | Negative | -.140 | -.189 |
| Kolmogorov-Smirnov Z | | .885 | .691 |
| Asymp. Sig. (2-tailed) | | .413 | .726 |

a. Test distribution is Normal.

Skewness is a measure of asymmetry of the distribution of the series around it‘s mean. The skewness of a symmetric distribution, such as the normal distribution, is zero.

Positive skewness means that the distribution has a long right tail and negative skewness implies that the distribution has a long left tail. Kurtosis measures the peakedness or flatness of the distribution of the series. The kurtosis of the normal distribution is three (3). If the kurtosis exceeds 3, the distribution is peaked

(leptokurtic) relative to the normal; if the kurtosis is less than 3, the distribution is flat (platykurtic) relative to the normal. Jarque-Berais is also a test statistic for testing whether the series is normally distributed. The test statistic measures the difference of the skewness and kurtosis of the series with those from the normal distribution. The test of normality on the enrollment rejects the null hypothesis of normality at 0.05 levels of significance while the test fails to reject the null hypothesis of normality for the claims data. These two separate tests (One-Sample Kolmogorov-Smirnov and Jacque-Bera) of normality of the two quantities of enrollment and claims leave this study to accept the normality assumption for the data.

| | ENROLLMENT | CLAIMS |
|---|---|---|
| Mean | 5806.618 | 135942.7 |
| Median | 5357.000 | 139356.9 |
| Maximum | 16070.00 | 197990.6 |
| Minimum | 2034.000 | 63613.09 |
| Std. Dev. | 2490.455 | 40316.19 |
| Skewness | 1.915721 | -0.225478 |
| Kurtosis | 7.664743 | 1.758442 |
| | | |
| Jarque-Bera | 83.50781 | 3.053446 |
| Probability | 0.000000 | 0.217246 |
| | | |
| Sum | 319364.0 | 5709592. |
| Sum Sq. Dev. | 3.35E+08 | 6.66E+10 |
| | | |
| Observations | 55 | 42 |

The study employs the Paired-Sampled T test first. One of the most common experimental designs is the "pre-post" design. A study of this type often consists of two measurements taken on the same subject, one before and one after the

introduction of a treatment or a stimulus. The basic idea is simple. If the treatment had no effect, the average difference between the measurements is equal to 0 and the null hypothesis holds. On the other hand, if the treatment did have an effect (intended or unintended!), the average difference is not 0 and the null hypothesis is rejected.

The Paired-Samples T Test is now by no means the appropriate procedure which is used in the study for testing the hypothesis of no difference between levels of registration and claims payment prior to BMS and after BMS. Separate tables in appendix I provide descriptive statistics like mean, standard deviation and correlation test. The correlation between the levels of registration between the two periods is also not statistically significant at the 0.05 levels of significance. Similar thing can be said about the correlation between claims payment over the two regimes or periods.

The paired samples test table 4.1 below has the column headed mean. This column displays the average difference between monthly enrollment and claims payment between the two periods. The other columns have the standard deviation, standard error, confidence interval, etc. information which are followed in order for difference in sample between the two periods. The Std. Error Mean column provides an index of the variability one can expect in repeated random samples of 12 monthly values of registration and payments. The t statistic is obtained by dividing the mean difference by its standard error. The Sig. (2-tailed) column has the vital information for drawing a conclusion. Also called P-Value, it displays the probability of obtaining a t statistic whose absolute value is equal to or greater than the obtained t statistic.

Since the significance value for change in both registration and claims payment are greater than 0.05, the study can conclude that the average difference of -481.677 registration and 12615.450 claims payment are due to chance variation, and cannot be attributed to the BMS.

**Table 4.1 Paired Samples Test**

| | Paired Differences | t | Df | Sig. (2-tailed) |
|---|---|---|---|---|

| | | Mean | Std. Deviation | Std. Error-Mean | 95% Confidence Interval of the Difference | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Lower | Upper | | | |
| Pair 1 | Monthly Enrollment/Registration Post BMS - Monthly Enrollment/Registration Pre BMS | -481.667 | 2,837.921 | 819.237 | -2,284.796 | 1,321.462 | -.588 | 11 | .568 |
| Pair 2 | Monthly Claims Payment Post BMS - Monthly Claims Payment Pre BMS | 12,615.450 | 57,044.065 | 16,467.203 | -23,628.619 | 48,859.519 | .766 | 11 | .460 |



### 4.2 Trend Analysis

The simple linear regression analysis below is conducted to provide an initial check of whether the level of monthly claim paid is linearly related to monthly levels of enrollment with dataset ranging from January, 2011 to June, 2015. It is earlier tested (See Appendix I) that the correlation between the two variables in question is not statistically significant. This is confirmed hear with the regression analysis Table 4.2.0 below. The test on the regression coefficient (-4.051017) proves to be statistically insignificant. Thus, the null hypothesis of no regression could not be rejected at 0.05 levels of significance. This means that observed marginal contribution of monthly level of registration to claim payment can be said to be zero.

| | | |
|---|---|---|
| Dependent Variable: Cl | | |
| Method: Least Squares | | |
| Date: 08/23/15 Time: | Std. Error | |
| Sample: 2012M01 201: | | |
| Included observations: 42 | 15176.13 | |

| Variable | Coefficient | | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 159344.9 | | 10.49970 | 0.0000 |
| Enrollment | -4.051017 | 2.406527 | -1.683345 | 0.1001 |

**Table 4.2.0 Linear Regression**



| | | | |
|---|---|---|---|
| R-squared | 0.066155 | Mean dependent var | 135942.7 |
| Adjusted R-squared | 0.042809 | S.D. dependent var | 40316.19 |
| S.E. of regression | 39443.81 | Akaike info criterion | 24.04959 |
| Sum squared resid | 6.22E+10 | Schwarz criterion | 24.13234 |
| Log likelihood | -503.0414 | Hannan-Quinn criter. | 24.07992 |
| F-statistic | 2.833652 | Durbin-Watson stat | 0.917661 |
| Prob(F-statistic) | 0.100099 | | |

The poor nature of possible linear relationship between the levels of registration and claims necessitates the incorporation of time (trend) into the model. The nature of trend in the monthly enrollment onto the scheme and the monthly claims payment is assessed through a line graph (See Appendix II) which provides a visual image of the long term trend in the quantities. The graph is used as the first step in order to observe trends in the data if any. However, it appears there is no such phenomenal trend in the two datasets (Enrollment and Claims).

It is important to note that in analysing trends of data and ignoring the fact that two series contain a time trend (are trending together) can lead us to falsely conclude that changes in one variable actually cause changes in the other variable. This is because relationship between two or more trending variables simply because they are growing over time could be described as spurious regression. The good news is that adding a time-trend to the regression eliminates this problem. However, the incorporation of time-trend to the linear regression renders the coefficient of enrollment still insignificant as seen in the table below.

**Table 4.2.1**

Dependent Variable: CL
Method: Least Squares
Date: 08/24/15 Time: (
Sample: 2012M01 2015
Included observations: 42

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 98973.72 | 18592.03 | 5.323449 | 0.0000 |
| ENROLLMENT | -3.898992 | 1.992015 | -1.957310 | 0.0575 |
| @TREND | 1830.552 | 415.6430 | 4.404146 | 0.0001 |

| | | | |
|---|---|---|---|
| R-squared | 0.376333 | Mean dependent var | 135942.7 |
| Adjusted R-squared | 0.344350 | S.D. dependent var | 40316.19 |
| S.E. of regression | 32644.91 | Akaike info criterion | 23.69351 |
| Sum squared resid | 4.16E+10 | Schwarz criterion | 23.81763 |
| Log likelihood | -494.5638 | Hannan-Quinn criter. | 23.73901 |
| F-statistic | 11.76669 | Durbin-Watson stat | 1.364686 |
| Prob(F-statistic) | 0.000100 | | |

### 4.2.1 Trend Pattern in Enrollment and Claims

The trend equations in the in tables 4.2.2 and 4.2.3 below (see also appendix II) indicate a positive or upward linear trend in the enrollment and claims respectively over the stipulated period. The trend coefficient in the claims seem to very significant while that of the enrollment is not. This is evident in the figures 4.2.1 and 4.2.2 below enrollment and claims respectively over the stipulated period (January 2011 to July, 2015). The coefficient of determination in both claims and enrollment analyses is reported as 0.315069 and 0.000753.

**Table 4.2.2**

Dependent Variable: CLAIMS
Method: Least Squares
Date: 08/23/15 Time: 18:52
Sample: 2012M01 2015M06
Included observations: 42

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| 75991.54 | | 14916.52 | 5.094453 | 0.0000 |
| @TREND | 1844.650 | 430.0359 | 4.289525 | 0.0001 |

| | | | |
|---|---|---|---|
| R-squared | 0.315069 | Mean dependent var | 135942.7 |
| Adjusted R-squared | 0.297946 | S.D. dependent var | 40316.19 |
| S.E. of regression | 33780.41 | Akaike info criterion | 23.73960 |
| Sum squared resid | 4.56E+10 | Schwarz criterion | 23.82234 |
| Log likelihood | -496.5316 | Hannan-Quinn criter. | 23.76993 |
| F-statistic | 18.40003 | Durbin-Watson stat | 1.148040 |
| Prob(F-statistic) | 0.000110 | | |

Dependent Variable: EI
Method: Least Squares
Date: 08/23/15 Time:
Sample: 2011M01 201:
Included observations: 54

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 5614.009 | 661.5247 | 8.486469 | 0.0000 |
| @TREND | 4.260301 | 21.51750 | 0.197992 | 0.8438 |

**Table 4.2.3**

| | | | |
|---|---|---|---|
| R-squared | 0.000753 | Mean dependent var | 5726.907 |
| Adjusted R-squared | -0.018463 | S.D. dependent var | 2441.995 |
| S.E. of regression | 2464.435 | Akaike info criterion | 18.49365 |
| Sum squared resid | 3.16E+08 | Schwarz criterion | 18.56731 |
| Log likelihood | -497.3285 | Hannan-Quinn criter. | 18.52206 |
| F-statistic | 0.039201 | Durbin-Watson stat | 1.467961 |
| Prob(F-statistic) | 0.843823 | | |

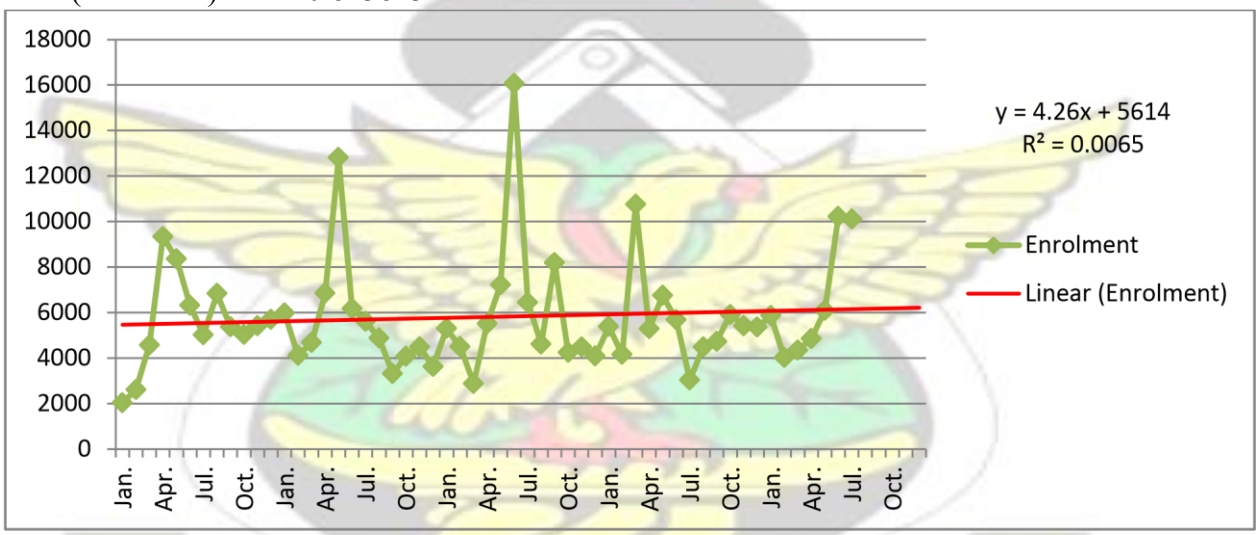


**Figure 4.2.1 Enrollments Time Plot**

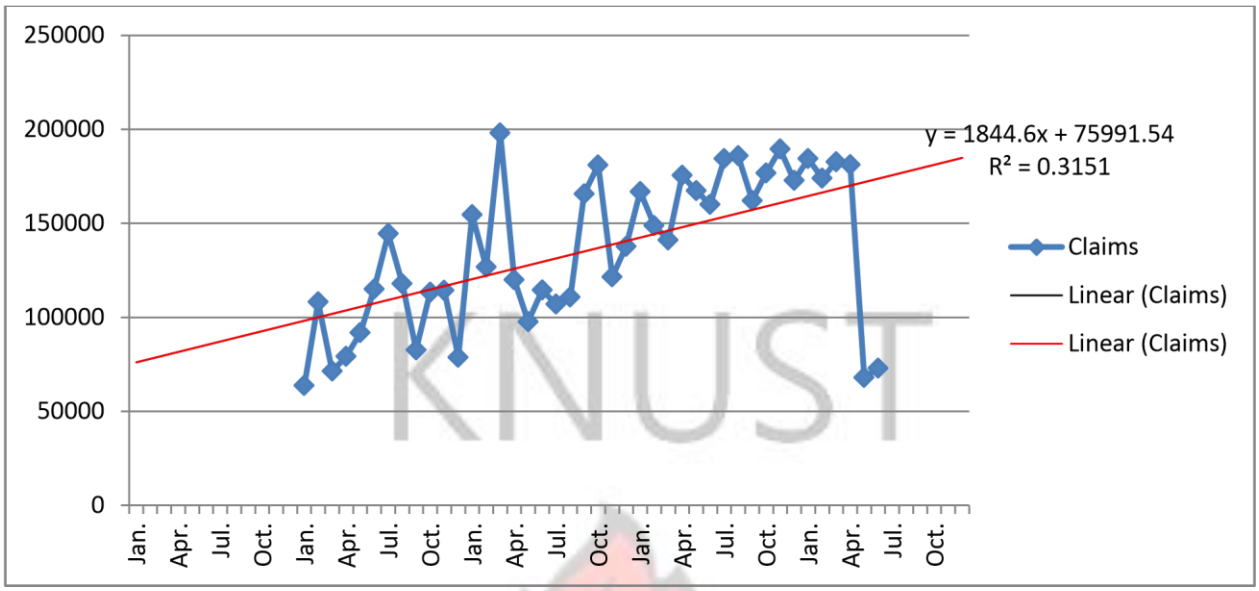


**Figure 4.2.2 Claims time Plot**

The trend in the monthly enrollment of clients onto the scheme over the period under consideration could be modeled using the linear equation:

$$Y = 4.26X + 5614$$

On the other hand, monthly claims submitted by health service providers to the district could also be modeled by the linear equation:

$$Y = 1844.65X + 75991.54$$

The table below illustrates quarterly percentage changes in level of registration onto the scheme (Enrollment) and levels of claims submitted by health service providers. Similar table for monthly percentage changes in enrollment and claims are shown in Appendix II. Generally, levels of enrollment seem to be back and forth with some months and quarters experiencing a decrease in figures of registration. It is only claims which had at most of the times seen a positive change in levels.

**Table 4.2.4 Quarterly Percentage Change**

| Qtr | Enroll. | Claims |
|---|---|---|
| 2013Q03 | -0.332 | 0.155 |
| 2013Q04 | -0.333 | 0.148 |
| 2014Q01 | 0.580 | 0.037 |

| | | |
|---|---|---|
| 2014Q02 | -0.127 | 0.101 |
| 2014Q03 | -0.309 | 0.059 |
| 2014Q04 | 0.363 | 0.012 |
| 2015Q01 | -0.148 | 0.004 |
| 2015Q02 | 0.488 | -0.405 |

The test for serial correlation in error term is done using the Durbin-Watson statistic. Serial correlation is a common occurrence in time series data because the data is ordered (over time); it is therefore not surprising that neighboring error terms turn out to be correlated.

When analysis detects serial correlation, something needs to be done. Serial correlation in the error term may be evidence of a serious problem of model misspecification. When the ultimate goal is to estimate a model with complete dynamics, you need to re-specify the model. However, when a researcher does not wish to estimate a fully dynamic model, but would like to carry out statistical inference, then something needs to be done to account for serial correlation so that

test statistics are valid.

The study attempts to improve the model for approximating the trend in monthly level of enrollment and claims by time series models like autoregression (AR), moving average (MA), and autoregression moving average (ARMA). The various analyses (see appendix III) indicate that the two quantities are best modeled by either the MA or AR but not the ARMA. For instance, the reported p-value of time-trend on claims proves to be significant at 0.05 levels of significance. However, this is not the case for enrollment with the reported p-value of 0.8438. The inclusion of moving average of order 1 provides better model to the claims payment. The computed p-values for the time-trend and first order moving average are respectively 0.0032 and 0.0044. In the case of enrollment, however, the first order moving average seems not to be an improved

model. The computed p-values for the time-trend and first order moving average are 0.7736 and 0.0637 respectively.

# CHAPTER FIVE



## SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

### 5.0 Summary of Findings

The effect of the Biometric Management System (BMS) on the enrollment and claims payment of the NHIS in the Asante Akim North district is assessed through PairedSample T test after satisfying the necessary conditions such as normality of distribution. The one-sample Kolmogorov-Smirnov test provided a strong evidence for the rejection of the non-normality and constant variation in the datasets. In all, twenty-four (24) data units (monthly registration over a twelve month period) was used with normal means of 5362.17 and 5843.83 for periods prior to BMS and post
BMS respectively. The standard deviations for the two periods are 1766.278 and 1979.434. The probability of the Z statistic (reported as 0.413 and 0.726) is greater than 0.05, meaning that the Normal distribution assumption with a parameter of 5362.17 and 5843.83 cannot be rejected.

The Paired-Samples T Test which is now by no means an appropriate procedure was employed by the study for testing the hypothesis of no difference between levels of registration and claims payment prior to BMS and after BMS. The first test is the correlation between levels of enrollment before and after BMS. The reported p-value in this test is 0.652 which convincingly reject the hypothesis of linear correlation between the datasets. Thus, enrollment prior to BMS and post BMS do not linearly correlated at 0.05 levels of significance. Similarly, the test rejects linear correlation between levels

of claims payment before and after BMS at 0.05 levels of significance as the computed p-value stands at 0.257.

Moreover, the difference in mean between levels of registration before and after BMS is -481.667=5362.17-5843.83. Similarly, the difference in mean between claims payment before and after BMS is 12615.450=161205.431-148589.981.The test provided significance value for change in both registration and claims payment which are respectively 0.568 and 0.460. These p-values are greater than 0.05, indicating that the average difference of -481.677 registration and 12615.450 claims payment are due to chance variation, and cannot be attributed to the BMS introduction.

The simple linear regression is used to confirm the absence of linear relationship between monthly registration and claims payment. The test on the regression coefficient (-4.051017) proves to be statistically insignificant. Thus, the null hypothesis of no regression could not be rejected at 0.05 levels of significance. This means that observed marginal contribution of monthly level of registration to claim payment can be said to be zero.

However, relationship between two or more trending variables simply because they are growing over time could also be an example of a spurious regression problem.

The good news is that adding a time-trend to the regression eliminates this problem. The incorporation of time-trend to the linear regression renders the coefficient of enrollment still insignificant (p-value equal 0.0575 as seen in the table 4.2.1.

The nature of trend in the monthly enrollment onto the scheme and the monthly claims payment is assessed through a separate line graphs which provides a visual image of the long term trend in the quantities. The graph is used as the first step in order to observe trends in the data if any. However, it appears there is no such phenomenal

upward trend in the Enrollment dataset over the period of January, 2011 to July, 2015 but that of Claims appears to have a phenomenal upward trend over same period.

The trend equations in the in tables 4.2.2 and 4.2.3 (see also appendix II) indicate a positive or upward linear trend in the enrollment and claims respectively over the stipulated period. The trend coefficient in the claims seem to very significant while that of the enrollment is not. The p-values for making that determination are respectively 0.0001 and 0.8438.The coefficient of determination in both claims and enrollment analyses is reported as 0.315069 and 0.000753 respectively giving an indication of possible bad model. The enrollment of clients is thus modeled by the linear equation

$$Y = 4.26X + 5614$$

while that of claims is modeled by the linear equation

$$Y = 1844.65X + 75991.54$$

The test for serial correlation in error term is done using the Durbin-Watson statistic which is reported as 1.148 and 1.468 respectively for claims and enrollment. This and many other tests reveal that perhaps, the most appropriate model for analyzing the trend in the claims and enrollment is the Auto-regression Moving Average (ARMA) or autoregressive (AR) or moving average (MA) of varying orders. The best observed model for claims so far is the first order moving average MA(1) while that of enrollment is remains inconclusive/indeterminate.

### 5.1 Conclusions

The major objectives of the study include the impact of BMS on both enrollments onto the NHIS in the districts and payment levels of claim. It is again to use this study to identify the nature of trend in the enrollment and claims payment under the scheme.

The mathematical and statistical models applied include the Pair-Sampled T test and ordinary least square analysis. The pair-sample T test is basically employed to assess the impact of the BMS on enrollment onto the scheme and claims paid to health providers in the district.

The analysis reveals that in fact, the BMS has not significantly change the number of monthly enrollment onto the scheme in the district. For instance, the test reported a pvalue of 0.568 which convincingly rejects the assertion that the BMS has affected the monthly level of registration onto the NHIS. Similarly, the reported p-value for the test of difference in levels of monthly claims payment by the scheme to health providers is 0.460. This again is an indication that the hypothesis of null difference in claims payment is upheld at 0.05 levels of significance.

The paired samples correlations between the monthly enrollment and claims payment before and after BMS also have computed p-value of 0.652 and 0.257 respectively which clearly indicate that there is no linear relationship between the variables in question. Thus, there is no linear relation between monthly enrollment level before BMS and monthly enrollment level after BMS. The same thing applies to claims payment.

The analysis has also indicated a very gentle upward trend in the levels of registration but a phenomenal or steep upward trend in claims payment over the period of January, 2011 to July, 2015. The time-trend regression coefficient for enrollment is 4.26 which is not statistically significant because of the reported p-value of 0.8438. However, the time-trend in claims is 1844.650 which is significant with a reported pvalue of 0.0001. Moreover, the existence of autocorrelation in these time trend analysis shows that moving average (MA) of first order could be approximately better model for forecasting claims while that of enrollment remains indeterminate.

## 5.2 Recommendation

The findings of this study necessitate a great deal of policy recommendations for the purpose of taking decisions on the operations of the health insurance scheme in the district as well as for academic exercises needed to fill certain gap in the discipline. The necessary recommendations from the study can, thus, be summarized in the following:

The BMS has not given immediate impact especially on claims payment as unexpected which needs management attention to probe further for possible reasons for such failure.

The significant positive trend in levels of monthly claims payment should be considered alongside the revenue levels to the scheme in the district to bring the two to an acceptable level of pegging. This is very necessary if the future sustenance and improvement of the scheme is under consideration.

The model specification needs further attention. The times series analysis for enrollment onto the scheme and claims payment to health providers need further studies to ascertain the order of the AR, MA, ARMA or ARIMA or any other possible functional form such as quadratic, logarithmic, exponential, etc. to aid in forecasting adequately the monthly enrollment and claims payment by the scheme.

The poor nature of linear relationship between monthly enrollment and monthly claims payment need further studies. It will be proper if total number of clients (subscribers) at a particular point in time (Monthly, Quarterly, etc.) could be ascertained to know how that relates to total claims payment.

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## APPENDIX I

**Paired Samples Statistics**

| | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| Pair 1 | Monthly Enrollment/Registration Post BMS | 5,362.17 | 12 | 1,766.278 | 509.881 |
| | Monthly Enrollment/Registration Pre BMS | 5,843.83 | 12 | 1,979.434 | 571.413 |
| Pair 2 | Monthly Claims Payment Post BMS | 161,205.43083 | 12 | 43,032.911619 | 12,422.531554 |
| | Monthly Claims Payment Pre BMS | 148,589.98083 | 12 | 25,156.763447 | 7,262.132074 |

**Paired Samples Correlations**

| | N | Correlation | Sig. |
|---|---|---|---|
| Pair 1 Monthly Enrollment/Registration Post BMS & Monthly Enrollment/Registration Pre BMS | 12 | -.145 | .652 |
| Pair 2 Monthly Claims Payment Post BMS & Monthly Claims Payment Pre BMS | 12 | -.355 | .257 |

**Ranks**

| | | N | Mean Rank | Sum of Ranks |
|---|---|---|---|---|
| Monthly Enrollment/Registration Pre BMS - Monthly Enrollment/Registration Post BMS | Negative Ranks | 5[a] | 7.20 | 36.00 |
| | Positive Ranks | 7[b] | 6.00 | 42.00 |
| | Ties | 0[c] | | |

| | | | | |
|---|---|---|---|---|
| | Total | 12 | | |
| Monthly Claims Payment Pre BMS - Monthly Claims Payment Post BMS | Negative Ranks | 8[d] | 6.50 | 52.00 |
| | Positive Ranks | 4[e] | 6.50 | 26.00 |
| | Ties | 0[f] | | |
| | Total | 12 | | |

a. Monthly Enrollment/Registration Pre BMS < Monthly Enrollment/Registration Post BMS

b. Monthly Enrollment/Registration Pre BMS > Monthly Enrollment/Registration Post BMS

c. Monthly Enrollment/Registration Pre BMS = Monthly Enrollment/Registration Post BMS

d. Monthly Claims Payment Pre BMS < Monthly Claims Payment Post BMS

e. Monthly Claims Payment Pre BMS > Monthly Claims Payment Post BMS

f. Monthly Claims Payment Pre BMS = Monthly Claims Payment Post BMS

**Test Statistics**

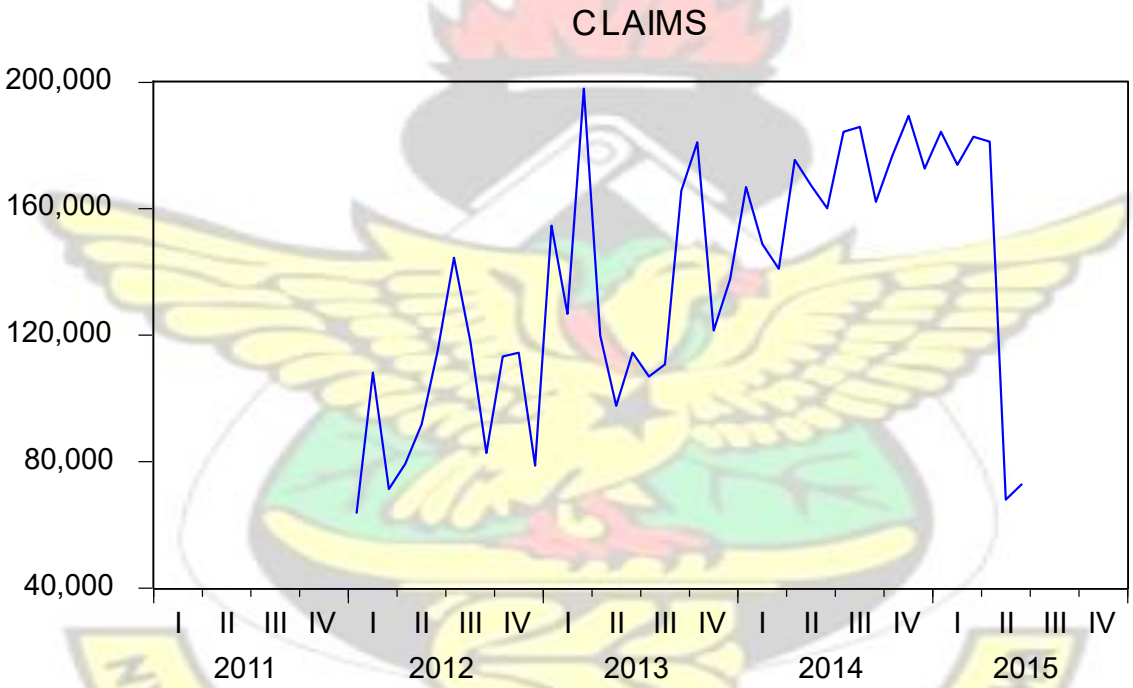
| | Monthly Enrollment/Registration Pre BMS - Monthly Enrollment/Registration Post BMS | Monthly Claims Payment Pre BMS - Monthly Claims Payment Post BMS |
|---|---|---|

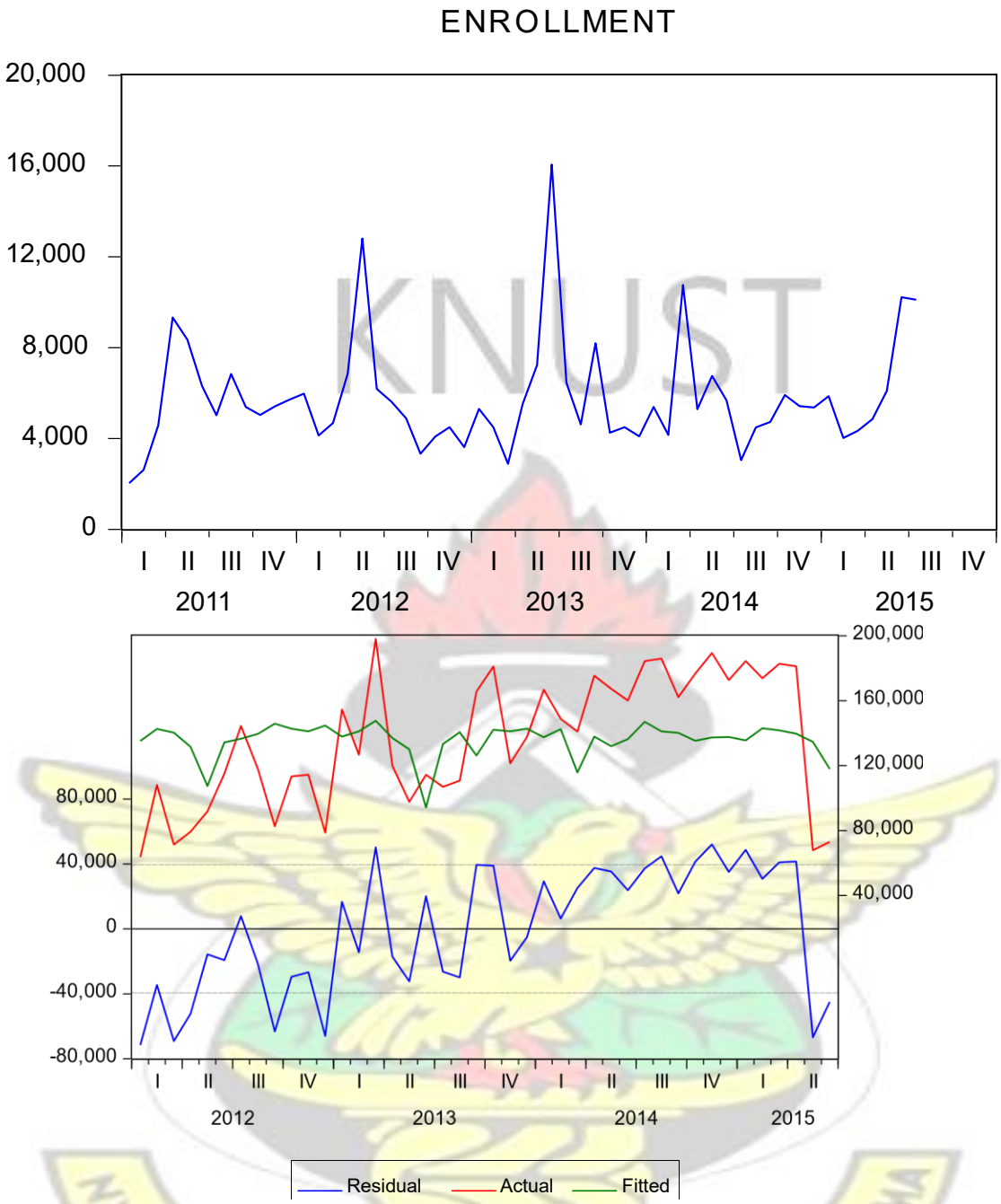
| | | |
|---|---|---|
| Z | -.235[a] | -1.020[b] |
| Asymp. Sig. (2-tailed) | .814 | .308 |

a. Based on negative ranks

b. Based on positive ranks

c. Wilcoxon Signed Ranks Test **APPENDIX II TREND ANALYSIS**






| Month | Enroll. | Claims |
|---|---|---|
| Jul. 2013 | -0.599 | -0.066 |
| Aug. 2013 | -0.284 | 0.036 |
| Sept. 2013 | 0.773 | 0.496 |
| Oct. 2013 | -0.480 | 0.093 |
| Nov. 2013 | 0.056 | -0.329 |
| Dec. 2013 | -0.089 | 0.133 |
| Jan. 2014 | 0.315 | 0.212 |
| Feb. 2014 | -0.228 | -0.108 |
| Mar. 2014 | 1.587 | -0.052 |

| | | |
|---|---|---|
| Apr. 2014 | -0.508 | 0.244 |
| May-14 | 0.277 | -0.047 |
| Jun. 2014 | -0.159 | -0.043 |
| Jul. 2014 | -0.465 | 0.152 |
| Aug. 2014 | 0.475 | 0.008 |
| Sept. 2014 | 0.054 | -0.128 |
| Oct. 2014 | 0.251 | 0.090 |
| Nov. 2014 | -0.084 | 0.072 |
| Dec. 2014 | -0.012 | -0.088 |
| Jan. 2015 | 0.094 | 0.068 |
| Feb. 2015 | -0.314 | -0.057 |
| Mar. 2015 | 0.080 | 0.051 |
| Apr. 2015 | 0.118 | -0.008 |
| May-15 | 0.255 | -0.625 |
| Jun. 2015 | 0.676 | 0.074 |

Dependent Variable: CLAIMS
Method: Least Squares
Date: 08/24/15 Time: 06:55
Sample: 2012M01 2015M06
Included observations: 42

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 98973.72 | 18592.03 | | |
| ENROLLMENT | -3.898992 | 1.992015 | -3.323449 | 0.0000 |
| @TREND | 1830.552 | 415.6430 | 1.957310 | 0.0575 |
| | | | 4.404146 | 0.0001 |

| | | | |
|---|---|---|---|
| R-squared | 0.376333 | Mean dependent var | 135942.7 |
| Adjusted R-squared | 0.344350 | S.D. dependent var | 40316.19 |
| S.E. of regression | 32644.91 | Akaike info criterion | 23.69351 |
| Sum squared resid | 4.16E+10 | Schwarz criterion | 23.81763 |
| Log likelihood | -494.5638 | Hannan-Quinn criter. | 23.73901 |
| F-statistic | 11.76669 | Durbin-Watson stat | 1.364686 |
| Prob(F-statistic) | 0.000100 | | |

Date: 08/23/15 Time: 09:40
Sample: 2011M01 2015M12
Included observations: 55

| Autocorrelation | Partial Correlation | | AC | PAC | Q-Stat | Prob |
|---|---|---|---|---|---|---|
| . \|** \| | . \|** \| | 1 | 0.259 | 0.259 | 3.8905 | 0.049 |
| . \| . \| | .*\| . \| | 2 | -0.045 | -0.120 | 4.0083 | 0.135 |
| .*\| . \| | .*\| . \| | 3 | -0.162 | -0.128 | 5.5841 | 0.134 |
| **\| . \| | .*\| . \| | 4 | -0.213 | -0.154 | 8.3816 | 0.079 |
| .*\| . \| | .*\| . \| | 5 | -0.145 | -0.079 | 9.6998 | 0.084 |
| .*\| . \| | .*\| . \| | 6 | -0.129 | -0.133 | 10.770 | 0.096 |
| .*\| . \| | .*\| . \| | 7 | -0.107 | -0.126 | 11.515 | 0.118 |
| . \| . \| | .*\| . \| | 8 | -0.048 | -0.089 | 11.667 | 0.167 |
| . \|*. \| | . \| . \| | 9 | 0.078 | 0.018 | 12.080 | 0.209 |
| .*\| . \| | **\| . \| | 10 | -0.130 | -0.294 | 13.249 | 0.210 |
| . \| . \| | . \| . \| | 11 | -0.016 | -0.017 | 13.267 | 0.276 |
| . \| . \| | . \| . \| | 12 | 0.068 | -0.032 | 13.603 | 0.327 |
| . \|** \| | . \|** \| | 13 | 0.274 | 0.216 | 19.205 | 0.117 |
| . \| . \| | **\| . \| | 14 | 0.016 | -0.253 | 19.224 | 0.157 |
| .*\| . \| | .*\| . \| | 15 | -0.122 | -0.093 | 20.387 | 0.158 |
| . \| . \| | . \| . \| | 16 | -0.032 | 0.030 | 20.470 | 0.200 |
| .*\| . \| | .*\| . \| | 17 | -0.084 | -0.092 | 21.049 | 0.224 |
| .*\| . \| | **\| . \| | 18 | -0.108 | -0.217 | 22.046 | 0.230 |
| .*\| . \| | . \| . \| | 19 | -0.095 | -0.055 | 22.833 | 0.245 |
| .*\| . \| | .*\| . \| | 20 | -0.075 | -0.175 | 23.333 | 0.273 |
| . \| . \| | .*\| . \| | 21 | -0.021 | -0.145 | 23.372 | 0.324 |
| . \|*. \| | .*\| . \| | 22 | 0.150 | -0.098 | 25.517 | 0.273 |
| . \| . \| | . \| . \| | 23 | 0.032 | -0.063 | 25.620 | 0.319 |
| . \|** \| | . \|*. \| | 24 | 0.241 | 0.161 | 31.511 | 0.140 |

Date: 08/23/15 Time: 09:39
Sample: 2011M01 2015M12
Included observations: 41

| Autocorrelation | Partial Correlation | | AC | PAC | Q-Stat | Prob |
|---|---|---|---|---|---|---|
| **\| . \| | **\| . \| | 1 | -0.298 | -0.298 | 3.9011 | 0.048 |
| .*\| . \| | **\| . \| | 2 | -0.105 | -0.212 | 4.3974 | 0.111 |
| . \|*. \| | . \| . \| | 3 | 0.076 | -0.029 | 4.6642 | 0.198 |
| . \| . \| | . \| . \| | 4 | -0.044 | -0.056 | 4.7583 | 0.313 |
| .*\| . \| | .*\| . \| | 5 | -0.071 | -0.106 | 5.0086 | 0.415 |
| . \| . \| | .*\| . \| | 6 | 0.013 | -0.070 | 5.0173 | 0.542 |

| | | | | | | |
|---|---|---|---|---|---|---|
| . \|*. \| | . \| . \| | 7 | 0.089 | 0.055 | 5.4281 | 0.608 |
| . \| . \| | . \|*. \| | 8 | 0.066 | 0.133 | 5.6608 | 0.685 |
| . \| . \| | . \|*. \| | 9 | 0.007 | 0.113 | 5.6638 | 0.773 |
| .*\| . \| | .*\| . \| | 10 | -0.134 | -0.090 | 6.6904 | 0.754 |
| . \|*. \| | . \| . \| | 11 | 0.125 | 0.072 | 7.6038 | 0.748 |
| .*\| . \| | .*\| . \| | 12 | -0.158 | -0.125 | 9.1264 | 0.692 |
| . \| . \| | . \| . \| | 13 | 0.026 | -0.020 | 9.1691 | 0.760 |
| . \| . \| | . \| . \| | 14 | 0.020 | -0.054 | 9.1941 | 0.818 |
| . \|*. \| | . \| . \| | 15 | 0.080 | 0.060 | 9.6288 | 0.842 |
| .*\| . \| | .*\| . \| | 16 | -0.087 | -0.074 | 10.168 | 0.858 |
| . \| . \| | .*\| . \| | 17 | -0.039 | -0.086 | 10.281 | 0.891 |
| . \|*. \| | . \|*. \| | 18 | 0.122 | 0.077 | 11.419 | 0.876 |
| . \| . \| | . \|*. \| | 19 | -0.019 | 0.086 | 11.448 | 0.908 |
| .*\| . \| | . \| . \| | 20 | -0.092 | -0.034 | 12.157 | 0.911 |

**APPENDIX III CORRECTION OF AUTOCORRELATION**

Dependent Variable: CLAIMS
Method: Least Squares
Date: 08/23/15 Time: 22:09
Sample (adjusted): 2012M02 2015M06
Included observations: 41 after adjustments
Convergence achieved after 5 iterations

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 91329.39 | 26360.51 | 3.464629 | 0.0013 |
| @TREND | 1381.594 | 747.3137 | 1.848748 | 0.0723 |
| AR(1) | 0.404877 | 0.171886 | 2.355493 | 0.0238 |

| | | | |
|---|---|---|---|
| R-squared | 0.368746 | Mean dependent var | 137706.8 |
| Adjusted R-squared | 0.335522 | S.D. dependent var | 39141.42 |
| S.E. of regression | 31906.33 | Akaike info criterion | 23.64935 |
| Sum squared resid | 3.87E+10 | chwarz criterion | 23.77474 |
| Log likelihood | -481.8117 | Hannan-Quinn criter. | 23.69501 |
| F-statistic | 11.09882 | Durbin-Watson stat | 1.850237 |

Inverted AR Roots .40

Dependent Variable: CLAIMS

Method: Least Squares
Date: 08/23/15 Time: 22:12
Sample (adjusted): 2012M03 2015M06
Included observations: 40 after adjustments

Convergence achieved after 5 iterations

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 82662.34 | 26051.15 | 3.173079 | 0.0031 |
| @TREND | 1634.338 | 760.3440 | 2.149472 | 0.0384 |
| AR(1) | 0.425456 | 0.178270 | 2.386584 | 0.0224 |
| AR(2) | -0.093824 | 0.229788 | -0.408307 | 0.6855 |

| | | | |
|---|---|---|---|
| R-squared | 0.367616 | Mean dependent var | 138445.8 |
| Adjusted R-squared | 0.314917 | S.D. dependent var | 39349.34 |
| S.E. of regression | 32569.35 | Akaike info criterion | 23.71477 |
| Sum squared resid | 3.82E+10 | Schwarz criterion | 23.88366 |
| Log likelihood | -470.2954 | Hannan-Quinn criter. | 23.77584 |
| F-statistic | 6.975800 | Durbin-Watson stat | 1.843818 |
| Prob(F-statistic) | 0.000809 | | |
| Inverted AR Roots | .21+.22i | .21-.22i | |

Dependent Variable: CLAIMS
Method: Least Squares
Date: 08/23/15 Time: 22:33
Sample: 2012M01 2015M06
Included observations: 42
Convergence achieved after 7 iterations
MA Backcast: 2011M12

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 77056.88 | 19833.52 | 3.885185 | 0.0004 |
| @TREND | 1789.739 | 569.6326 | 3.141918 | 0.0032 |
| MA(1) | 0.428814 | 0.141983 | 3.020190 | 0.0044 |

| | | | |
|---|---|---|---|
| R-squared | 0.409486 | Mean dependent var | 135942.7 |
| Adjusted R-squared | 0.379203 | S.D. dependent var | 40316.19 |
| S.E. of regression | 31765.39 | Akaike info criterion | 23.63889 |
| Sum squared resid | 3.94E+10 | Schwarz criterion | 23.76301 |
| Log likelihood | -493.4167 | Hannan-Quinn criter. | 23.68439 |
| F-statistic | 13.52208 | Durbin-Watson stat | 1.957578 |
| Prob(F-statistic) | 0.000035 | | |
| Inverted MA Roots | -.43 | | |

Dependent Variable: CLAIMS
Method: Least Squares
Date: 08/23/15 Time: 22:44
Sample: 2012M01 2015M06
Included observations: 42
Convergence achieved after 8 iterations
MA Backcast: 2011M11 2011M12

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 77200.91 | 20506.28 | 3.764745 | 0.0006 |
| @TREND | 1783.731 | 593.2922 | 3.006496 | 0.0047 |
| MA(1) | 0.433481 | 0.171168 | 2.532481 | 0.0156 |
| MA(2) | 0.012427 | 0.196559 | 0.063223 | 0.9499 |
| | | | | = 135942.7 |

| | | | |
|---|---|---|---|
| R-squared | 0.409543 | Mean dependent var | |
| Adjusted R-squared | 0.362928 | S.D. dependent var | 40316.19 |
| S.E. of regression | 32179.10 | Akaike info criterion | 23.68641 |
| Sum squared resid | 3.93E+10 | Schwarz criterion | 23.85191 |
| Log likelihood | -493.4147 | Hannan-Quinn criter. | 23.74707 |
| F-statistic | 8.785638 | Durbin-Watson stat | 1.964890 |
| Prob(F-statistic) | 0.000149 | | |

| | | |
|---|---|---|
| Inverted MA Roots | -.03 | -.40 |

Dependent Variable: ENROLLMENT
Method: Least Squares
Date: 08/24/15 Time: 15:44
Sample: 2011M01 2015M06
Included observations: 54
Convergence achieved after 6 iterations
MA Backcast: 2010M12

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 5535.788 | 812.6301 | 6.812188 | 0.0000 |
| @TREND | 7.628814 | 26.37579 | 0.289236 | 0.7736 |
| MA(1) | 0.262770 | 0.138648 | 1.895228 | 0.0637 |
| | | | | = 5726.907 |

| | | | |
|---|---|---|---|
| R-squared | 0.059534 | Mean dependent var | |
| Adjusted R-squared | 0.022653 | S.D. dependent var | 2441.995 |

| | | | |
|---|---|---|---|
| S.E. of regression | 2414.177 | Akaike info criterion | 18.47006 |
| Sum squared resid | 2.97E+08 | Schwarz criterion | 18.58056 |
| Log likelihood | -495.6915 | Hannan-Quinn criter. | 18.51267 |
| F-statistic | 1.614225 | Durbin-Watson stat | 1.929195 |
| Prob(F-statistic) | 0.209048 | | |

| | |
|---|---|
| Inverted MA Roots | -.26 |



Dependent V ariable: CLAIMS
Method: Least Squares
Date: 08/24/15 Time: 15:54
Sample (adjusted): 2012M02 2015M06
Included observations: 41 after adjustments
Convergence achieved after 8 iterations
MA Backcast: 2012M01

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 82651.77 | 20845.10 | 3.965045 | 0.0003 |
| @TREND | 1654.078 | 595.4281 | 2.777964 | 0.0085 |
| AR(1) | -0.069301 | 0.377518 | -0.183570 | 0.8554 |
| MA(1) | 0.486836 | 0.325708 | 1.494700 | 0.1435 |
| | | | | 137706.8 |

| | | | |
|---|---|---|---|
| R-squared | 0.384850 | Mean dependent var | |
| Adjusted R-squared | 0.334973 | S.D. dependent var | 39141.42 |
| S.E. of regression | 31919.51 | Akaike info criterion | 23.67229 |
| Sum squared resid | 3.77E+10 | Schwarz criterion | 23.83947 |
| Log likelihood | -481.2820 | Hannan-Quinn criter. | 23.73317 |
| F-statistic | 7.715981 | Durbin-Watson stat | 1.891084 |
| Prob(F-statistic) | 0.000398 | | |

| | |
|---|---|
| Inverted AR Roots | -.07 |
| Inverted MA Roots | -.49 |